MASS-TRANSFER APPARATUS

FIELD OF THE INVENTION

[0001] The present invention relates to a mass-transfer apparatus. More particularly this invention concerns an apparatus for transferring mass between a liquid and a gas.

BACKGROUND OF THE INVENTION

[0002] In a known apparatus for mass transfer between a liquid and a gas inside a rotor having a packing, the liquid is introduced at the center of the rotor and driven outward through the packing by the centrifugal force generated by rotation of the rotor, and the gas surrounding the rotor is forced inward through the rotor by the gas pressure, counter to the liquid flow in the rotor.

[0003] WO 2015/101826 (U.S. Pat. No. 9,987,589) and WO 2016/038480 (US 2017/0028311) disclose mass-transfer machines having a rotor that has two spaced disks, a packing that drives centrally delivered liquid outward as the rotor rotates in the space between the two faces. Here the rotor is surrounded by a gas that due to the gas pressure flows through the rotor counter to the liquid, in order to produce a mass transfer between the liquid and the gas.

OBJECTS OF THE INVENTION

[0004] It is therefore an object of the present invention to provide an improved mass-transfer apparatus.

[0005] Another object is the provision of such an improved mass-transfer apparatus that overcomes the above-given disadvantages, in particular in which the mass transfer and the transport of material are substantially improved and operating times are reduced. The apparatus should moreover be easy to manufacture, assemble and use.

SUMMARY OF THE INVENTION

[0006] An apparatus for mass transfer between a liquid and a gas inside a rotor having a packing and where

[0007] the liquid is introduced at a center of the rotor and driven outward through the packing by centrifugal force generated by rotation of the rotor, and

[0008] the gas surrounding the rotor is forced inward through the rotor by a pressure of the gas, counter to the liquid flow in the rotor,

the improvement wherein the packing inside the rotor is divided into individual packing segments that together form a circular disk, each circular ring segment is formed by at least one structured packing comprised of a plurality of superimposed woven, knitted, mesh or lattice structured surfaces composed of metal, in particular sheet-metal strips, or plastic or glass fibers, to which the axis of rotation of the rotor runs perpendicular.

[0009] Dividing the packing situated in the rotor into individual packing segments having a woven, knitted, mesh or lattice structure leads to a substantial improvement in the mass transfer and the transport with shorter operating times. The rotor is assembled from individual packing segments that in turn are assembled from separate structured surfaces, which makes the production process especially easy and moreover affords the advantage that in their structure and the types and dimensions of the structured surface the structured packings can be adapted very precisely to the particular requirements.

[0010] It is particularly advantageous here if the structured surfaces are undulating with the undulations of each structured surface lying parallel to one another. It has also proved advantageous both in terms of the effect and in terms of production if the undulations of the structured surface are of zigzag-shaped cross section. In addition, it is also proposed that the undulations of one structured surface be arranged at an angle, in particular at right angles, to the undulations of an adjacent structured surface, so that intersecting flow passages exist between two structured surfaces.

[0011] It is proposed that preferably the structured surfaces are composed of metal and/or plastic wires or sheet-metal strips or glass fibers. Here the metal and/or plastic wires may have a diameter of 0.1 to 0.5, preferably 0.15 to 0.2 mm.

[0012] It is advantageous if the structured packing situated in the rotor is assembled from 2 to 64, preferably 4 to 16 packing segments. In terms of design it is proposed that the inner ends of packing segments form an inner, cylindrical, coaxial annular space from which the flow passages extend and into which the liquid is delivered. It is also proposed for this purpose that the outer ends of the packing segments form an outer cylindrical ring, in which the flow passages of the packing segments terminate.

[0013] It has proved particularly advantageous if the packing segments are assembled from 3 to 10, preferably 5 to 8, superimposed structured surfaces. The structured surfaces of a packing segment may also be spot-welded to one another, in particular by means of laser beams.

[0014] The production of rotors of larger diameter is facilitated if the structured packing of the rotor comprises structured packing rings coaxial with one another, which are divided into individual circular ring segments. It is also proposed that the rotor comprise two circular spaced disks to which the axis of rotation of the rotor runs perpendicular and that form a space between them that is filled by the packing segments.

BRIEF DESCRIPTION OF THE DRAWING

[0015] The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

[0016] FIG. **1** is a section through the rotor of the mass-transfer apparatus according to the invention;

[0017] FIG. **2** is a large-scale perspective view of a packing segment assembled from structured surfaces;

[0018] FIG. **3** is a top view of a structured surface;

[0019] FIG. **4** is a schematic section according to line IV-IV of FIG. **3**; and

[0020] FIGS. **5** and **6** are sections through rotors having structured packing rings composed of individual circular ring segments.

SPECIFIC DESCRIPTION OF THE INVENTION

[0021] The mass-transfer apparatus according to the invention comprises a rotor **1** having two coaxial, circular spaced disks **2** that are parallel to one another and form a space filled by a packing. Here the packing comprises individual packing segments **3** in the form of circular ring segments, so that the inner ends of the packing segments **3** form an inner cylindrical, coaxial or cylindrical annular space **4** to the liquid is supplied. The outer, curved ends of